Space Weather Technical Forecast

Issued on Tuesday, 24 October 2023 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity.
Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity as recorded at GOES16 has been Low with two C-class flares from the AR3468 region, the largest a C2.3 peaking at 23/1957 UTC. There are currently up to three sunspot regions on the visible disc, all of which are small and magnetically simple.

Two prominence eruptions were observed in the past 24hrs, one from over the northwest limb around 23/0900 UTC, and the other from the southwest limb around 23/1315 UTC. These are both likely far-sided and missing Earth, pending analysis. No other Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, has been at Ambient levels, averaging around 350 km/s through the period, peaking briefly at 397 km/s at 23/1747 UTC. The solar wind density was at below average values. The Interplanetary Magnetic Field (IMF), Bt, was at weak levels, ranging between 8 and 4nT. The north-south component, Bz, varied between +8 and -2nT. The phi angle varied through the period. The resulting geomagnetic activity was Quiet (Kp0-1).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at Background levels.

GOES16 high energy (greater than 2MeV) electron flux was at Normal Background levels. The associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold. The observation at 24/0001UTC was 2.8e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain Low or Very Low, with a Chance of isolated C-Class flares that may increase a little through the period.

Solar Wind / Geomagnetic Activity: No significant CMEs feature in the forecast. The forecast is for mainly Quiet (Kp0-2) geomagnetic activity. Up to two fast wind streams are due, a low confidence and low impact feature perhaps due early on Day 1, and then a more probable coronal hole possibly arriving from Day 3 onwards, with a peak Slight Chance of G1 Minor Storm (Kp5) levels.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at Background levels.

High energy electron flux (greater than 2MeV) is expected to remain at Normal Background levels, with a Slight Chance of a late rise from CH64's fast wind.

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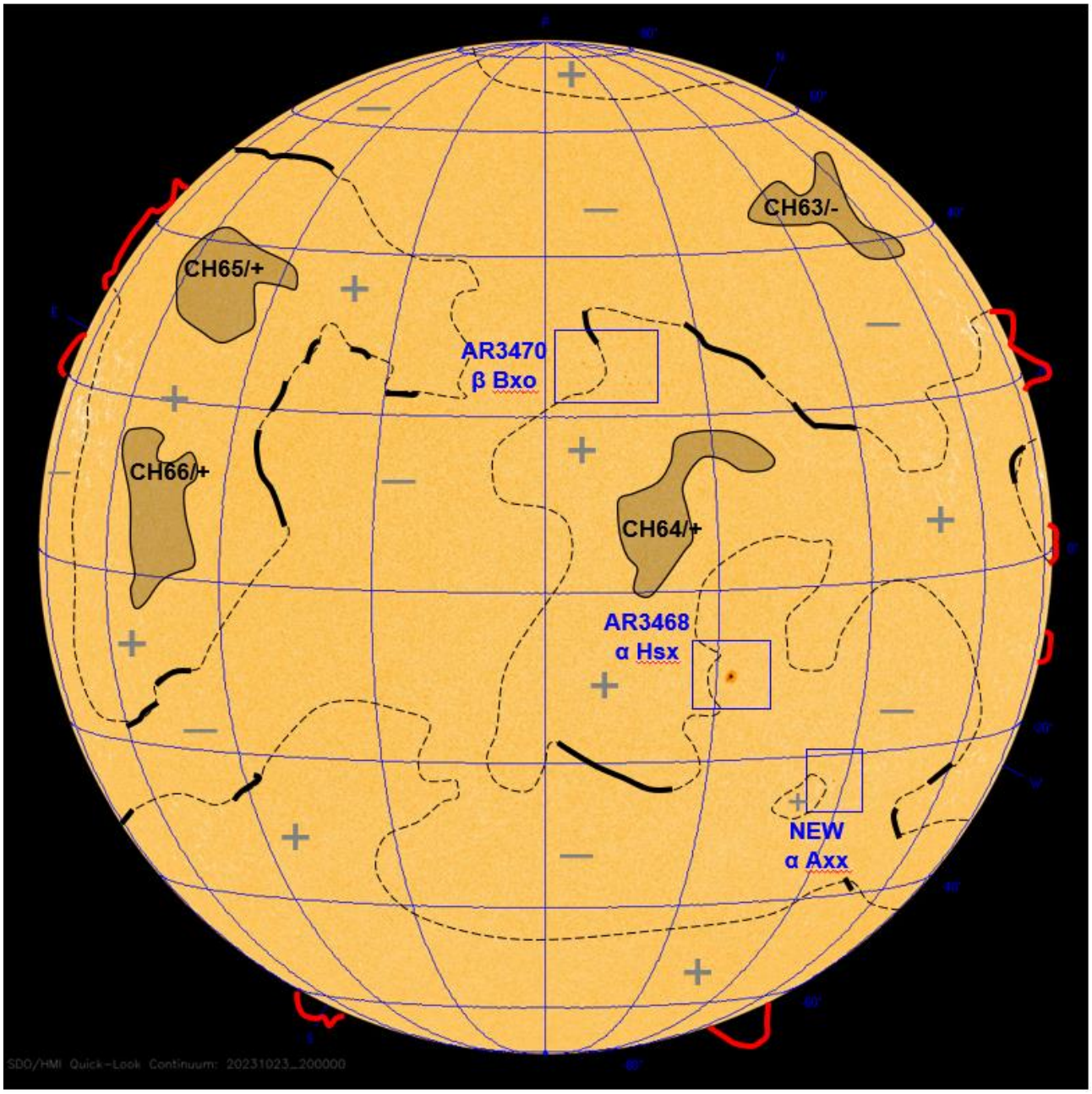
Figure 1. Solar Analysis Valid 23/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
No significant CMEs feature in this four-day period.

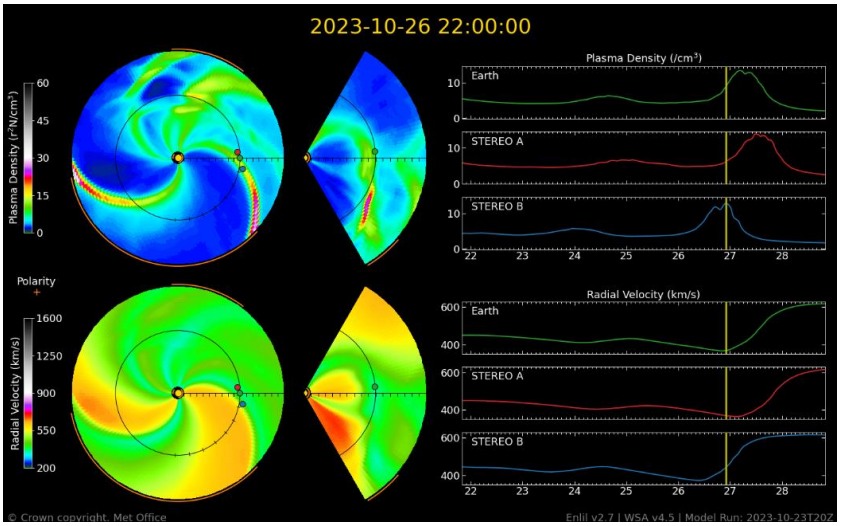
The coronal hole forecast is low confidence, but is unlikely to be significantly impactful in the coming four days. No coronal hole on the last rotation significantly surpassed 500km/s, and there are no major intensifications in EUV since then, and we are relatively further from the equinox to dampen the contribution from positive polarity features a little.

The forecast comprises early potential influence from CH63/- and then a later influence from CH64/+. CH63/- is the lower confidence feature for both presence and impacts, given its high solar latitude and its negative polarity. CH64/+ is situated closer to the Suns equator, and may influence Earth from late Day 2 (25 Sep), but is probably more likely on Day 3 (26 Sep). This is a positive polarity feature and may give a greater risk of geomagnetic enhancement at this time of year. The Enlil model shows this coronal hole high speed stream, albeit with a slightly later arrival time than mentioned above.

Geomagnetic activity is likely to be mainly predominantly Quiet (Kp0-2) over the coming period, with a Slight Chance of Unsettled to Active (Kp3-4) intervals at first due to CH63/-, increasing to a Chance risk from Day 3 onwards due to CH64/+, with a peak Slight Chance of attaining G1 Minor Storm levels (Kp5).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC Enlil model showing possible arrival of high speed stream duw to CH64/+



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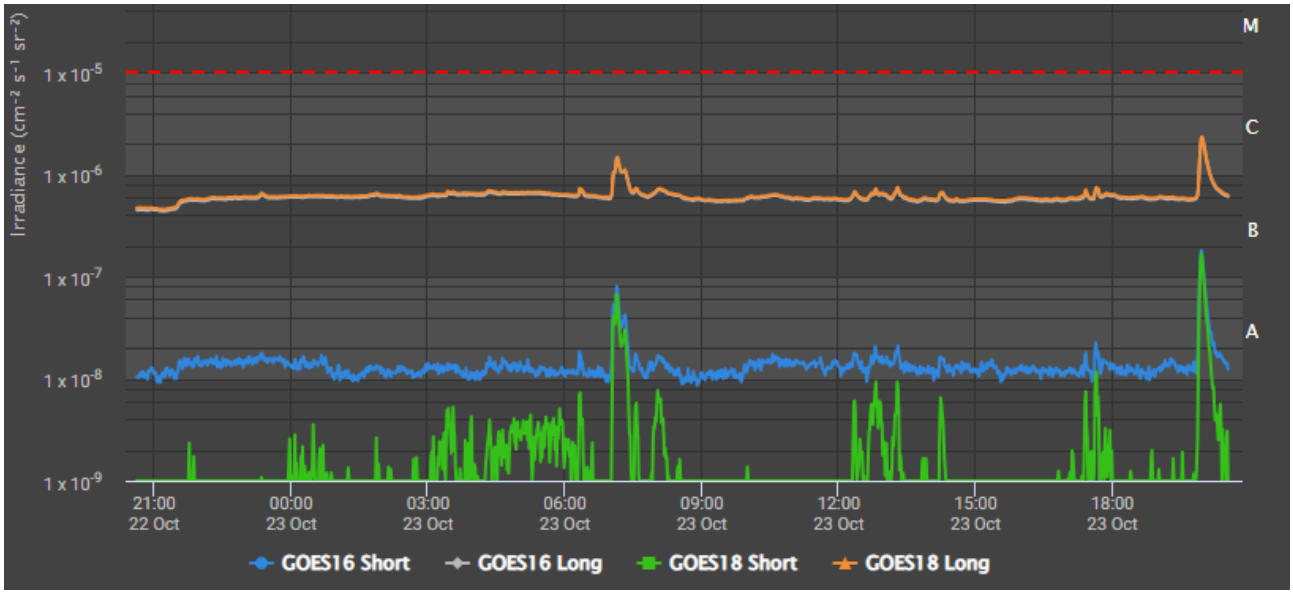
Radio Blackouts - X-Ray Flares:
There are currently just three sunspot regions on the Earth-facing disc, and these are small and simple at the present time, with only AR3468 showing any flare activity. A plage region rotating around the northeast limb at present will be monitored for any potential spot development.

Given the prospect of arrivals from far side sounding signals, an increasing Slight Chance of M-class flares is possible over the next four days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	2	2	5	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES 16 & 18 X-ray flux



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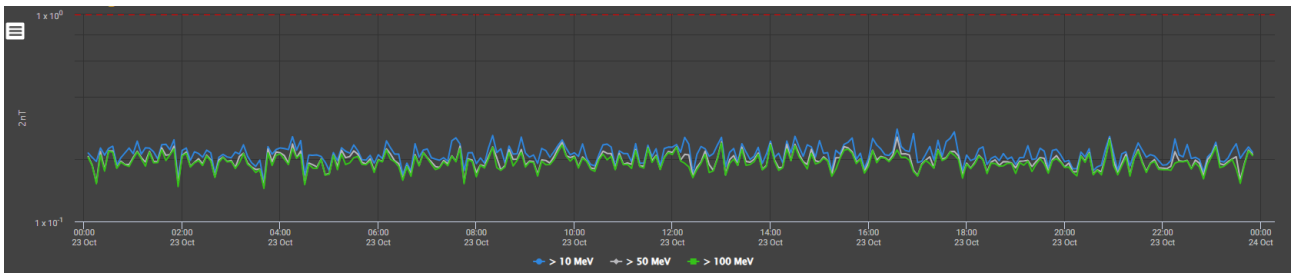
Solar Radiation Storms - (High Energy Protons):
The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels in the absence of significant sunspot regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES 16 Proton flux



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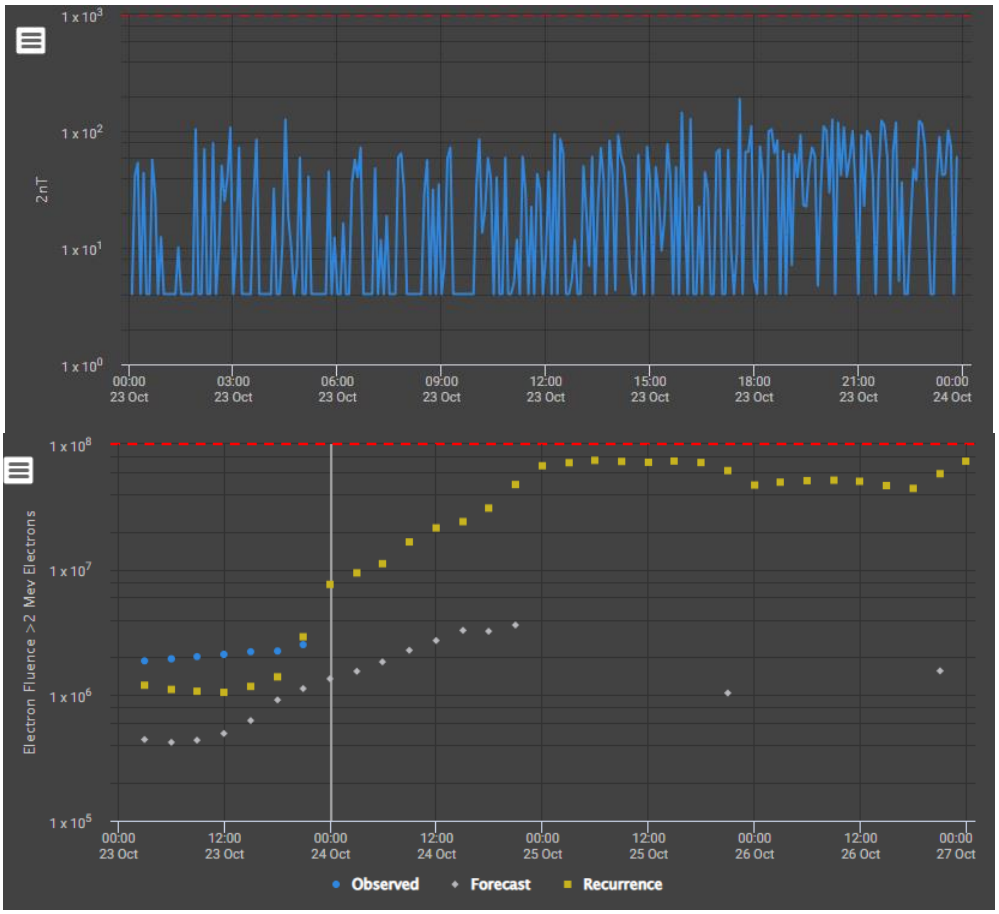
High Energy Electrons Event (≥ 2MeV):
Electron flux observed by GOES16 at GEO is currently at Normal Background levels and is very likely to remain here given the expected relative lack of CMEs and modest potency of inbound coronal holes' fast winds - at least until the possible arrival of CH64/+.

Persistence forecasting for the 24-hour fluence is polluted by CMEs from the last rotation, however the latest MOSWOC REFM is almost unmoved from current 24-hour fluence levels across its full 72-hour range. This may be expected to show more of an uptick due to the influence of CH64/+ from Day 3 onwards, however even this will probably fall short of Active levels.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES 16 Electron flux & Electron Fluence



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